

PRELIMINARY DATA SUMMARY

July 1987

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility in Duck, North Carolina. The data were collected and the analyses performed by the FRF staff. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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I. INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Fig.1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The FRF consists of a 561-m (1,840 ft) long concrete research pier supported on 0.91 m (3 ft) diameter steel piles. The pier deck is 6.1 m (20 ft) wide, 7.74 m (25.4 ft) above mean sea level (MSL), and extends from behind the dunes to approximately the 7.6 m (25 ft) depth contour. In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Most of the data are daily observations or the results of preliminary data analysis. In many instances, continuous analog records and more extensive analyses will be made available later by the CERC Coastal Engineering Information and Analysis Center (CEIAC).

Table 1 is a list of instruments used, their status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depth at the wave gages and current meters vary and may best be determined from the information contained in Figure 8. Other installation information is contained in Table 1. All times unless otherwise specified are referenced to Eastern Standard Time (EST).

Section II presents the meteorological data; Sections III through VI, oceanographic data; Section VII, nearshore profiles and bathymetry; and Section VIII, if included, documents special events that occurred at the FRF during the month.

Questions and/or comments concerning the data may be directed to Mr. Herman C. Miller at (919) 261-3511.

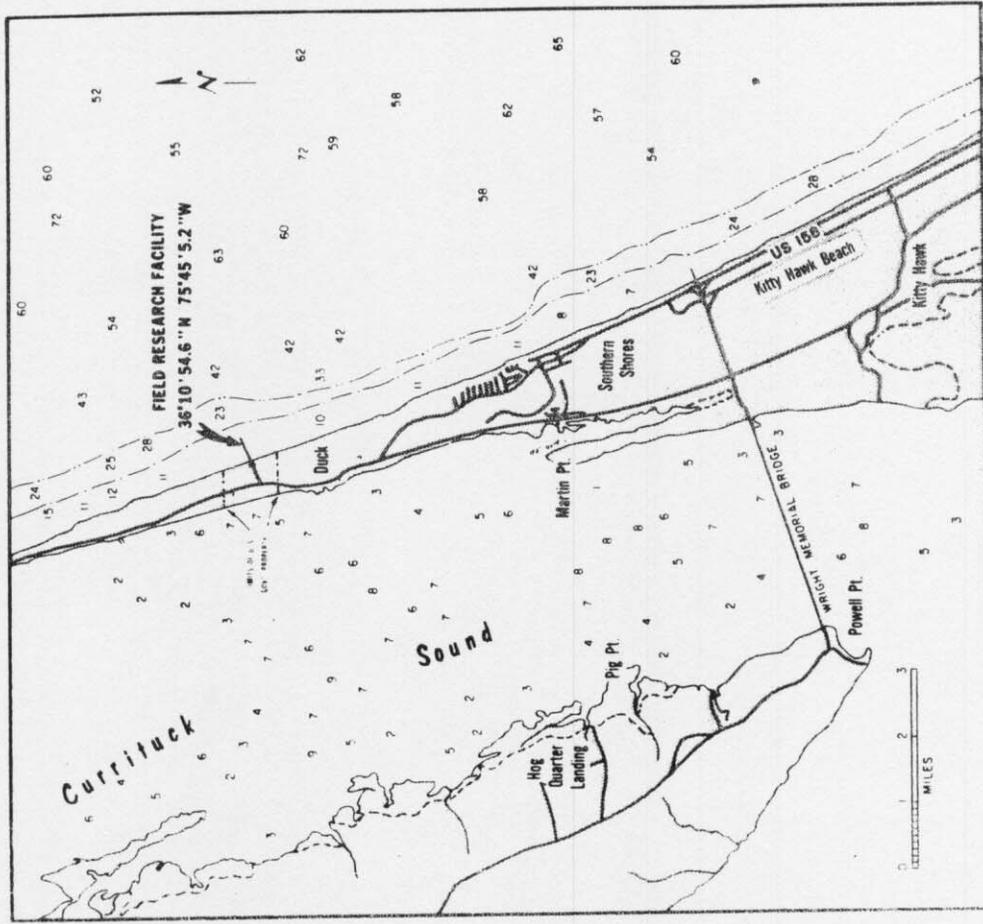
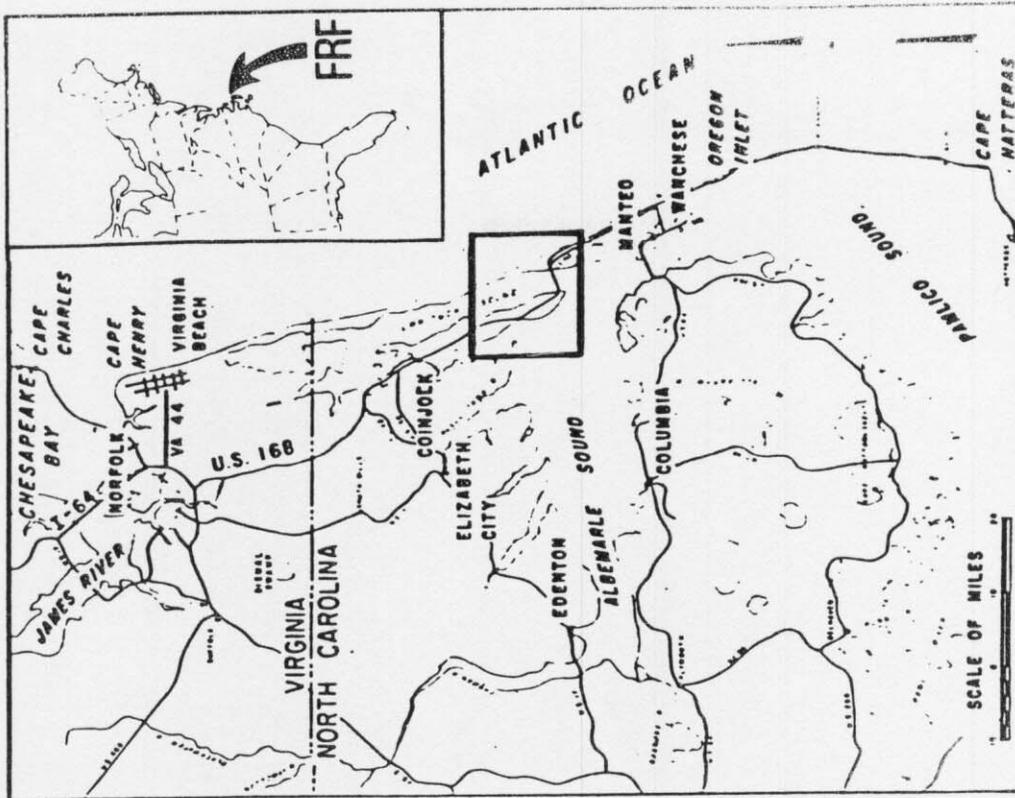


Figure 1. FRF location map

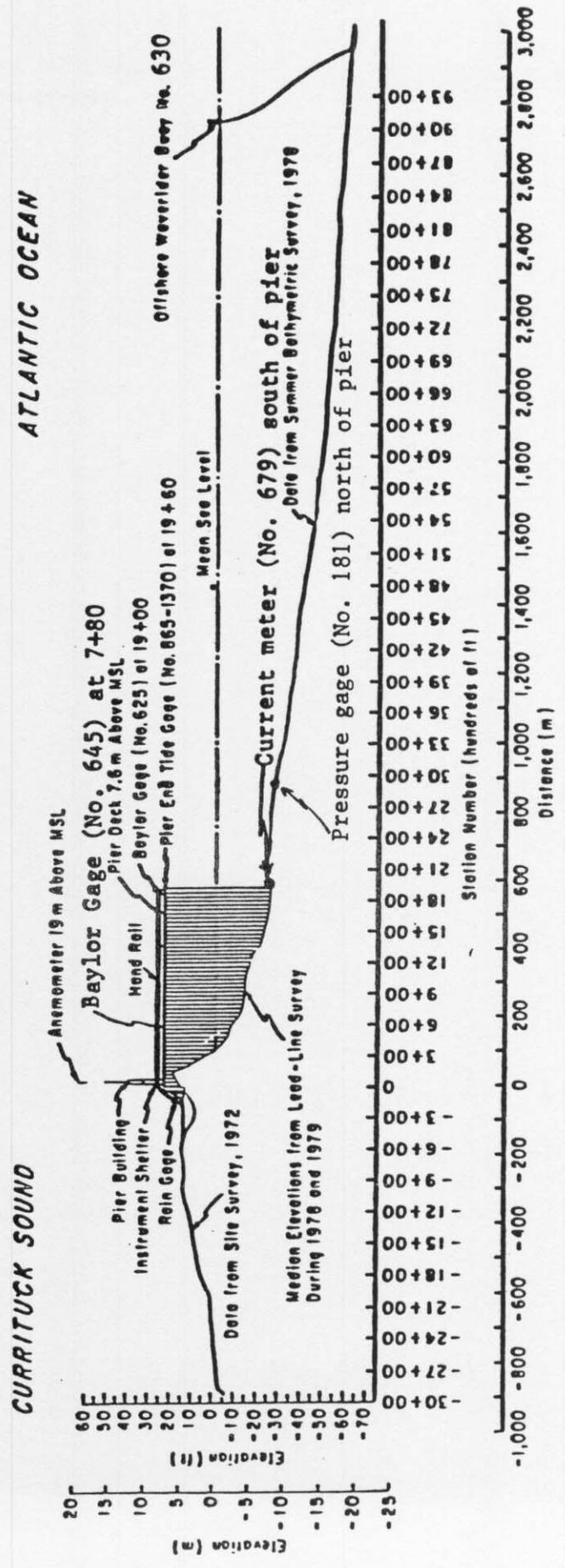
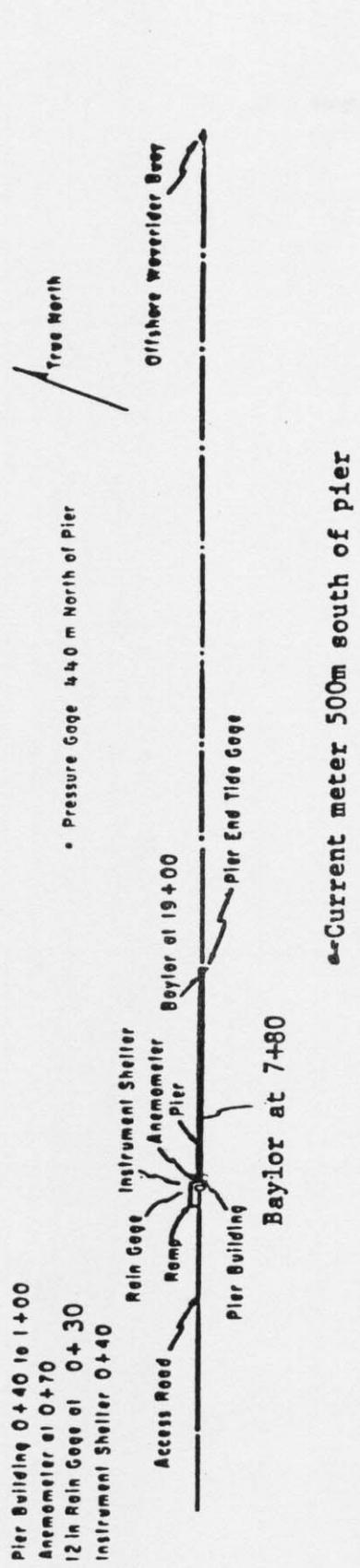


Figure 2. Instrument locations at FRR.

II. METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Fig. 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

The wind measurements are obtained from a Weather Measure Skyvane located on the FRF laboratory building (Fig. 2), 19.1 m above mean sea level (MSL).

The high and low temperatures are obtained from daily readings of NWS maximum and minimum thermometers and represent the extreme temperature values since the last reading.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in) -
 $\text{mm} \times .03937 = \text{in}$
2. Millibars (mb) to inches of mercury (in Hg) -
 $\text{mb} \times 0.02953 = \text{in Hg}$
3. Degrees Celcius (C) to degrees Fahrenheit (F) -
 $(\text{C} \times 9/5) + 32 = \text{F}$
4. Meters per second (m/s) to knots (kn) -
 $\text{m/s} \times 1.943 = \text{kn}$

TABLE 2: Meteorological Data

JUL 1987

Day	Hour	Wind Speed (m/s)	Wind Direction (deg TN)	Temperature (deg C)	Atm Pressure (mb)	Precipitation (mm)
1	100	6	225	25.0	1020.0	0
	700	6	229	25.9	1020.0	0
	1300	5	198	26.4	1018.7	5
	1900	7	218	26.3	1017.3	0
2	100	8	225	25.4	1018.7	0
	700	7	229	26.5	1019.3	0
	1300	5	200	29.7	1017.7	0
	1900	7	203	28.0	1017.0	0
3	100	9	221	26.4	1017.7	0
	700	8	224	27.0	1018.3	0
	1300	5	218	25.9	1018.3	15
	1900	6	221	24.0	1016.6	0
4	100	8	222	25.6	1017.7	0
	700	9	232	26.4	1017.3	0
	1300	7	216	29.4	1016.6	0
	1900	7	202	27.6	1015.3	0
5	100	8	215	26.3	1015.6	0
	700	7	235	26.1	1016.0	0
	1300	7	254	29.3	1016.0	0
	1900	3	1	20.9	1016.0	0
6	100	5	348	21.8	1018.0	0
	700	4	4	21.0	1019.0	0
	1300	4	31	24.1	1020.0	0
	1900	3	57	22.5	1019.3	0
7	100	0		22.5	1019.3	0
	700	4	126	24.4	1018.7	0
	1300	6	116	26.6	1018.0	0
	1900	3	194	27.0	1017.0	0
8	100	2	157	23.4	1017.0	0
	700	2	224	27.3	1017.3	0
	1300	4	138	30.6	1018.0	0
	1900	3	133	26.2	1017.3	0
9	100	2	166	23.7	1017.7	0
	700	3	275	29.0	1018.7	0
	1300		System down for repair			0
	1900	2	298	28.5	1016.0	0
10	100	4	254	28.7	1015.6	0
	700	4	278	29.0	1016.0	0
	1300	2	72	31.6	1015.6	0
	1900	3	120	27.4	1014.3	0
11	100	1	136	26.8	1014.6	0
	700	1	51	28.2	1015.3	0
	1300	1	153	28.2	1015.6	0
	1900	1	262	26.2	1014.3	0
12	100	1	302	24.7	1014.6	0
	700	2	14	26.3	1014.9	0
	1300	3	120	31.0	1013.9	0
	1900	3	129	27.3	1013.6	0
13	100	2	123	26.0	1012.2	0
	700	1	172	27.8	1013.3	0
	1300	3	60	30.0	1012.6	0
	1900	3	134	27.1	1011.2	0
14	100	3	214	26.9	1010.2	0
	700	4	234	27.8	1009.5	0
	1300	4	218	32.5	1008.2	0
	1900	7	241	25.1	1009.5	21
15	100	10	4	23.9	1012.2	0
	700	7	9	22.8	1016.0	0
	1300	3	52	22.4	1016.6	0
	1900	5	81	22.0	1016.0	0
16	100	6	52	23.1	1016.0	0
	700	8	51	22.4	1017.0	0
	1300	7	24	24.5	1019.0	0
	1900	6	53	23.1	1020.0	0

TABLE 2: Meteorological Data

JUL 1987

Day	Hour	Wind Speed (m/s)	Wind Direction (deg TN)	Temperature (deg C)	Atm Pressure (mb)	Precipitation (mm)
17	100	6	57	22.6	1022.4	0
	700	9	42	23.4	1024.8	0
	1300	6	28	25.0	1026.5	0
	1900	5	53	22.8	1025.8	0
18	100	4	66	22.0	1025.1	0
	700	3	332	22.7	1025.8	0
	1300	2	103	27.6	1024.4	0
	1900	4	152	23.8	1022.4	0
19	100	5	234	23.4	1021.7	0
	700	7	260	24.1	1022.1	0
	1300	3	212	30.4	1021.4	0
	1900	3	153	26.3	1020.4	0
20	100	7	239	25.0	1021.7	0
	700	4	270	25.3	1022.7	0
	1300	2	93	32.2	1022.4	0
	1900	3	283	28.1	1020.7	0
21	100	6	237	26.0	1020.7	0
	700	5	273	27.0	1021.0	0
	1300		System Backup			0
	1900	2	196	30.5	1018.3	0
22	100	4	257	28.1	1017.7	0
	700	2	292	28.6	1019.0	0
	1300	6	14	28.4	1018.7	0
	1900	5	58	25.7	1017.7	0
23	100	4	109	25.0	1017.3	0
	700	5	30	26.1	1019.0	0
	1300	5	73	28.2	1019.7	0
	1900	5	94	24.9	1018.3	0
24	100	2	107	24.5	1019.3	0
	700	4	68	26.4	1021.4	0
	1300	4	82	29.6	1021.7	0
	1900	5	112	26.5	1020.7	0
25	100	3	160	25.0	1021.0	0
	700	2	234	27.7	1021.7	0
	1300	4	122	31.0	1021.0	0
	1900	4	166	28.1	1018.7	0
26	100	5	217	26.8	1018.7	0
	700	6	240	26.8	1017.7	0
	1300	6	215	32.5	1015.6	0
	1900	4	194	29.7	1013.6	0
27	100	4	234	25.0	1013.9	14
	700	5	221	24.9	1014.6	0
	1300	2	97	27.7	1013.6	0
	1900	5	146	25.0	1011.9	0
28	100	4	242	25.8	1011.2	0
	700	4	229	25.3	1011.6	0
	1300	6	9	26.7	1011.9	0
	1900	1	30	24.9	1012.2	0
29	100	4	19	24.9	1013.3	0
	700	5	356	24.9	1015.3	0
	1300	6	39	27.4	1016.6	0
	1900	5	92	25.1	1016.0	0
30	100	1	163	22.4	1017.3	0
	700	1	46	26.4	1018.0	0
	1300	5	131	30.5	1018.7	0
	1900	4	168	26.5	1016.6	0
31	100	5	210	26.0	1017.7	0
	700	5	233	26.1	1017.3	0
	1300	4	215	31.2	1015.6	0
	1900	1	289	25.8	1014.6	0

III. WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 181) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hrs near 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for 34 minutes.

Wave height (H_{m0}) is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. The wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. The period (T_p) is that associated with the maximum energy density in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed for all data records collected. Figure 3 is a time history of the H_{m0} and T_p values for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

TABLE 3: WAVE DATA

Part 1

JUL 1987

Day	Hour	645		625		181		630	
		Baylor Hmo(m)	at 7+80 T(sec)	Baylor Hmo(m)	at 19+00 T(sec)	Pressure Hmo(m)	Gage T(sec)	Farshr Hmo(m)	Wvrdr T(sec)
1	0100	0.24	14.22	0.39	13.48	0.49	8.26	0.51	8.00
	0700	0.29	12.80	0.44	12.80	0.50	12.80	0.51	8.26
	1300	0.25	12.80	0.42	12.80	0.43	12.20	0.51	12.80
	1900	0.30	12.20	0.53	12.80	0.52	12.20	0.55	11.64
2	0100	0.29	12.20	0.44	12.20	0.49	12.20	0.58	11.14
	0700	0.32	11.14	0.44	12.20	0.48	8.26	0.55	11.64
	1300	0.32	12.20	0.48	11.64	0.52	11.64	0.61	11.64
	1900	0.37	11.14	0.56	11.14	0.52	7.76	0.71	11.64
3	0100	0.36	7.32	0.51	11.64	0.57	8.26	0.84	6.74
	0700	0.37	11.14	0.48	11.14	0.54	8.00	0.73	5.82
	1300	0.26	8.53	0.38	8.00	0.44	11.14	0.66	5.56
	1900	0.28	11.14	0.40	11.14	0.44	11.14	0.64	6.74
4	0100	0.26	10.66	0.38	8.00	0.43	7.76	0.67	8.00
	0700	0.32	5.56	0.42	10.66	0.41	10.66	0.70	5.69
	1300	0.24	10.24	0.37	7.76	0.34	8.00	0.55	5.56
	1900	0.33	7.53	0.44	7.53	0.37	7.53	0.65	5.45
5	0100	0.34	5.56	0.45	5.69	0.42	6.40	0.71	6.24
	0700	0.23	5.82	0.35	8.00	0.37	7.53	0.57	6.09
	1300	0.26	7.53	0.36	6.74	0.36	6.40	0.54	7.53
	1900	0.24	5.95	0.38	7.11	0.34	6.24	0.49	5.95
6	0100	0.24	15.06	0.33	6.24	0.32	8.00	0.48	5.95
	0700	0.30	3.51	0.38	7.76	0.32	3.28	0.49	7.76
	1300	0.36	3.37	0.49	3.51	0.40	3.41	0.55	7.32
	1900	0.31	4.13	0.36	4.00	0.33	3.51	0.48	6.57
7	0100	0.31	3.94	0.37	4.00	0.34	4.00	0.49	4.13
	0700	0.34	4.83	0.49	6.40	0.46	6.24	0.54	5.82
	1300	0.43	5.69	0.73	7.53	0.65	7.76	0.77	7.53
	1900	0.40	5.69	0.64	8.26	0.66	8.53	0.66	7.76
8	0100	0.33	7.53	0.62	8.00	0.69	7.53	0.69	8.26
	0700	0.32	8.83	0.59	8.00	0.65	8.53	0.68	8.26
	1300	0.29	8.26	0.55	7.32	0.67	8.26	0.63	7.32
	1900	0.33	8.53	0.48	7.76	0.58	8.26	0.55	7.76
9	0100	0.27	8.53	0.47	8.26	0.56	8.53	0.50	8.83
	0700	0.26	8.53	0.44	8.83	0.52	8.53	0.52	8.26
	1300			System down for repair					
	1900	0.30	9.84	0.45	8.53	0.56	8.53	0.48	8.26
10	0100	0.22	9.48	0.43	9.14	0.52	8.26	0.45	8.83
	0700	0.26	8.53	0.44	8.83	0.48	9.48	0.43	8.53
	1300	0.24	8.00	0.43	7.76	0.47	8.53	0.45	8.00
	1900	0.26	9.14	0.44	8.53	0.42	7.76	0.40	8.53
11	0100	0.20	8.00	0.31	8.53	0.39	8.26	0.36	8.53
	0700	0.19	7.53	0.32	8.00	0.38	8.00	0.36	8.26
	1300	0.19	9.14	0.31	8.26	0.37	8.00	0.38	8.00
	1900	0.21	8.00	0.32	7.76	0.33	8.00	0.30	8.83
12	0100	0.23	9.14	0.31	8.53	0.40	8.83	0.31	9.14
	0700	0.23	8.53	0.34	8.00	0.40	9.84	0.33	7.53
	1300	0.23	9.14	0.34	8.53	0.39	8.26	0.37	9.14
	1900	0.27	9.48	0.37	8.26	0.47	8.83	0.46	8.83
13	0100	0.33	9.14	0.42	8.53	0.55	8.26	0.40	8.53
	0700	0.26	8.53	0.41	8.00	0.49	8.83	0.44	8.00
	1300	0.30	8.53	0.43	8.83	0.54	8.26	0.42	8.53
	1900	0.32	8.53	0.47	8.53	0.57	8.83	0.46	8.26
14	0100	0.32	8.83	0.43	8.83	0.59	9.84	0.49	8.83
	0700	0.30	8.83	0.41	9.14	0.56	8.00	0.47	8.26
	1300	0.29	9.14	*		0.56	9.14	0.46	8.83
	1900	0.30	8.83	0.42	8.83	0.57	8.83	0.52	8.53
15	0100	0.77	3.94	0.93	3.82	0.55	4.06	1.01	4.13
	0700	1.15	5.45	1.14	5.56	0.93	5.33	1.28	5.56
	1300	0.89	6.09	0.85	6.24	0.73	5.33	0.94	5.33
	1900	0.76	5.82	0.72	5.82	0.73	5.69	0.76	5.95
16	0100	0.66	5.69	0.69	5.02	0.55	4.92	0.79	5.56
	0700	0.91	4.41	1.08	4.74	0.69	4.74	1.16	4.49
	1300	0.61	4.34	0.82	4.34	0.50	4.20	0.95	4.74
	1900	0.58	4.06	0.83	4.74	0.55	4.49	0.87	4.57

* Electronic problems

TABLE 3: WAVE DATA

Part 2

JUL 1987

Day	Hour	645		625		181		630	
		Baylor Hmo(m)	at 7+80 T(sec)	Baylor Hmo(m)	at 19+00 T(sec)	Pressure Hmo(m)	Gage T(sec)	Farshr Hmo(m)	Wvrdr T(sec)
17	0100	0.56	3.82	0.81	4.57	0.51	4.34	0.89	4.74
	0700	0.69	3.16	0.93	4.66	0.54	4.57	0.96	4.49
	1300	0.63	4.00	0.88	4.92	0.59	4.92	0.91	4.92
	1900	0.55	4.57	0.81	6.09	0.61	4.66	0.92	5.82
18	0100	0.55	4.92	0.79	5.95	0.63	6.09	0.88	5.95
	0700	0.46	5.69	0.70	7.76	0.68	5.82	0.74	6.09
	1300	0.45	5.56	0.73	5.56	0.76	8.26	0.80	7.32
	1900	0.38	9.14	0.74	9.14	0.76	8.53	0.69	7.76
19	0100	0.25	9.14	0.53	8.53	0.61	8.00	0.67	8.26
	0700	0.22	8.53	0.49	8.53	0.56	7.76	0.62	8.53
	1300	0.24	9.14	0.42	8.83	0.48	8.26	0.50	8.53
	1900	0.29	8.83	0.53	9.48	0.65	8.83	0.58	9.14
20	0100	0.26	9.14	0.52	8.83	0.70	9.48	0.72	9.14
	0700	0.22	9.48	0.42	8.83	0.59	8.83	0.50	9.14
	1300	0.31	8.83	0.50	8.83	0.65	8.83	0.49	9.14
	1900	0.27	8.83	0.64	8.83	0.58	8.83	0.49	8.83
21	0100	0.21	8.53	0.40	8.53	0.51	8.53	0.53	8.53
	0700	0.19	8.83	0.33	8.26	0.44	8.53	0.44	8.83
	1300			System Backup					
	1900	0.23	8.26	0.41	8.53	0.47	8.83	0.37	8.83
22	0100	0.31	8.53	0.44	8.53	0.58	8.26	0.38	8.00
	0700	0.32	2.75	0.46	8.83	0.51	8.53	0.48	8.26
	1300	0.45	2.91	0.60	8.83	0.52	8.53	0.70	8.00
	1900	0.40	3.71	0.50	8.53	0.49	8.00	0.60	8.53
23	0100	0.35	8.53	0.52	8.83	0.46	8.00	0.54	8.83
	0700	0.33	8.26	0.52	8.53	0.50	8.83	0.58	8.26
	1300	0.47	8.00	0.82	7.53	0.73	8.26	0.82	7.53
	1900	0.47	6.09	0.74	8.53	0.56	5.33	0.77	5.82
24	0100	0.33	3.88	0.58	8.26	0.54	7.11	0.64	5.69
	0700	0.35	5.02	0.62	8.00	0.49	6.09	0.60	8.00
	1300	0.36	5.45	0.60	9.14	0.53	5.22	0.63	8.83
	1900	0.38	4.92	0.62	9.14	0.52	8.83	0.62	8.83
25	0100	0.30	9.48	0.51	8.83	0.56	9.14	0.61	8.53
	0700	0.30	8.26	0.51	8.53	0.51	8.00	0.62	8.53
	1300	0.33	8.26	0.52	7.11	0.47	8.26	0.61	7.76
	1900	0.30	8.53	0.46	8.26	0.43	8.83	0.60	8.83
26	0100	0.19	8.00	0.35	8.26	0.39	8.53	0.47	7.76
	0700	0.16	7.76	0.32	8.26	0.36	7.76	0.38	7.53
	1300	0.19	9.48	0.32	8.83	0.34	8.83	0.41	8.26
	1900	0.31	8.83	0.44	8.53	0.42	8.53	0.47	8.00
27	0100	0.20	8.26	0.30	8.53	0.31	8.83	0.58	2.98
	0700	0.21	8.53	0.29	8.53	0.33	8.53	0.36	8.53
	1300			System down for repair					
	1900	0.26	5.82	0.47	7.76	0.38	8.00	0.50	7.53
28	0100	0.24	13.48	0.34	10.66	0.48	10.24	0.36	8.26
	0700	0.21	12.80	0.30	13.48	0.36	8.00	0.32	8.26
	1300	0.27	12.80	0.43	13.48	0.32	13.48	0.33	8.53
	1900	0.42	4.06	0.49	4.00	0.45	3.66	0.76	4.20
29	0100	0.48	4.74	0.59	4.92	0.45	4.00	0.69	4.06
	0700	0.39	4.13	0.51	4.06	0.39	4.13	0.61	3.88
	1300	0.46	4.00	0.55	3.94	0.42	3.71	0.63	4.34
	1900	0.55	4.41	0.69	4.27	0.51	4.57	0.74	4.49
30	0100	0.51	5.56	0.66	5.45	0.61	5.82	0.75	5.82
	0700	0.59	5.45	0.79	5.45	0.64	5.45	0.79	5.45
	1300	0.48	5.22	0.66	5.33	0.60	5.22	0.71	5.22
	1900	0.36	5.02	0.54	12.20	0.59	15.06	0.66	8.00
31	0100	0.28	15.06	0.45	15.06	0.54	15.06	0.50	8.26
	0700	0.27	15.06	0.44	15.06	0.49	12.20	0.47	12.20
	1300	0.25	10.66	0.39	11.64	0.54	15.06	0.44	11.64
	1900	0.33	15.06	0.49	14.22	0.60	14.22	0.61	7.76
Mean		0.35	7.86	0.52	8.25	0.51	7.97	0.59	7.56
Std dev		0.16	2.89	0.17	2.47	0.11	2.46	0.18	1.89

* Electronic problems

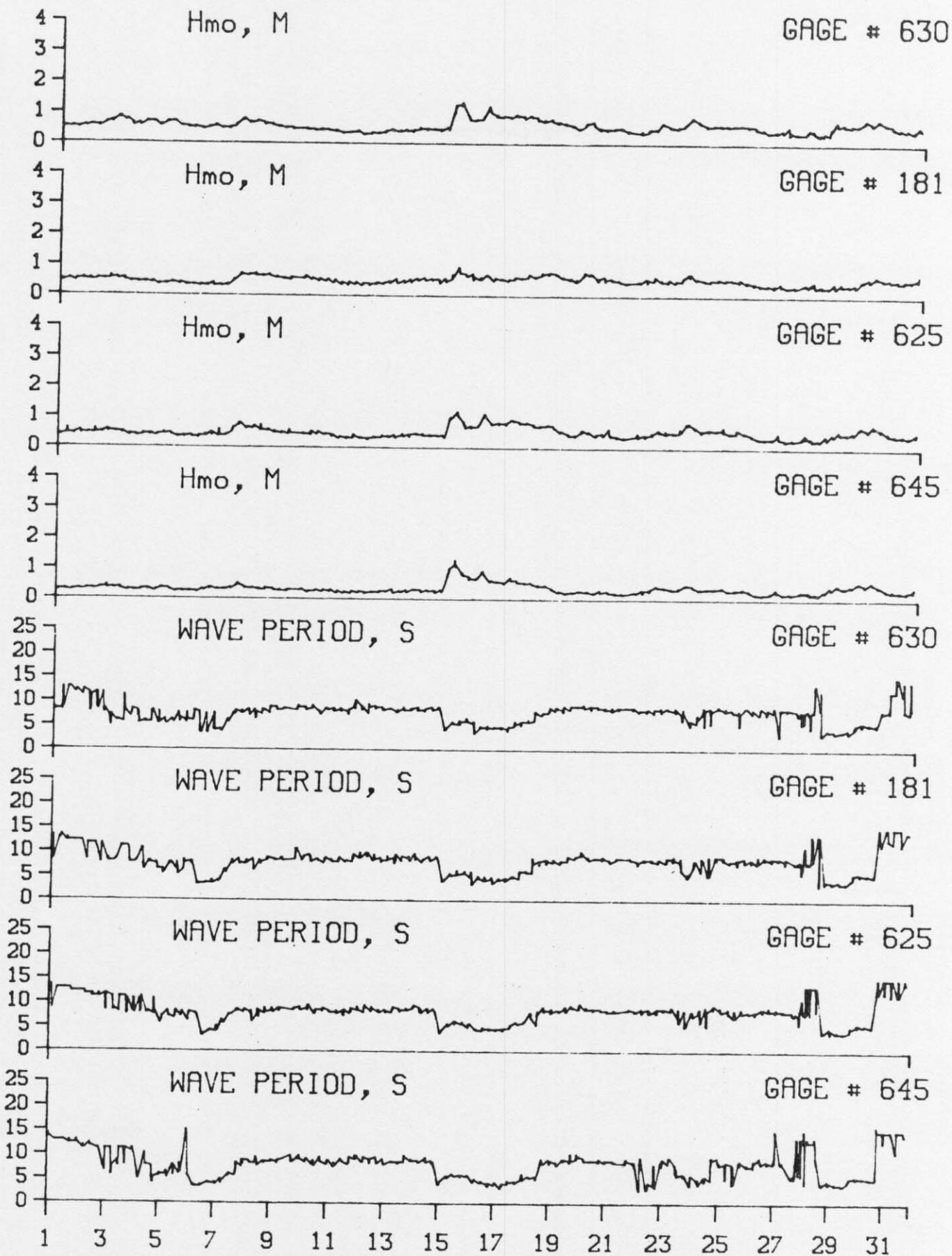


FIGURE 3. Time History of Wave Heights and Periods - July 1987

IV. CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, alongshore currents flow either toward 340 (i.e. northward) or toward 160 (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second.

TABLE 4: Current Data
JUL 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
1	0100	Along Cross Result									2 1 2	N off 7
1	0700	Along Cross Result	15 11 19	N off 17	152	51 25 57	N on 313	South	9	N	5 2 5	N off 2
1	1300	Along Cross Result									1 2 2	N off 43
1	1900	Along Cross Result									6 4 7	N off 14
2	0100	Along Cross Result									4 3 5	N off 17
2	0700	Along Cross Result	9 14 17	N off 36	165	30 8 31	N on 326	South	18	N	3 2 4	N off 14
2	1300	Along Cross Result									2 3 4	S on 216
2	1900	Along Cross Result									12 3 12	N off 354
3	0100	Along Cross Result									7 5 9	N off 16
3	0700	Along Cross Result	20 20 29	N off 25	165	61 15 63	N on 326	South	5	N	3 3 4	N off 25
3	1300	Along Cross Result									0 1 1	off 70
3	1900	Along Cross Result									10 2 10	N off 351
4	0100	Along Cross Result									11 2 11	N off 350
4	0700	Along Cross Result	20 15 25	N off 17	165	34 17 38	N on 313	South	18	N	8 3 9	N off 1
4	1300	Along Cross Result									2 2 3	N off 25
4	1900	Along Cross Result									7 2 7	N off 356
5	0100	Along Cross Result									10 2 10	N off 351
5	0700	Along Cross Result	no observ		201	0 0 0	off 129	South	5	N	2 3 4	N off 36
5	1300	Along Cross Result									1 0 1	N 340
5	1900	Along Cross Result									3 7 8	N on 273

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel

TABLE 4: Current Data
JUL 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
6	0100	-Along Cross Result									3 1 3	N on 322
6	0700	-Along Cross Result	30 8 31	S off 146	165	6 1 6	S off 146	North	15	N	11 3 11	S on 175
6	1300	-Along Cross Result									8 1 8	S off 153
6	1900	-Along Cross Result									11 2 11	S off 150
7	0100	-Along Cross Result									2 1 2	S on 187
7	0700	-Along Cross Result	30 8 31	S on 174	165	5 8 9	N off 36	South	13	N	11 0 11	S 160
7	1300	-Along Cross Result									14 2 14	S on 168
7	1900	-Along Cross Result									6 2 6	S on 178
8	0100	-Along Cross Result									0 1 1	 on 250
8	0700	-Along Cross Result	7 3 8	S off 133	177	55 33 65	N on 309	South	36	N	7 5 9	S on 196
8	1300	-Along Cross Result									2 3 4	N on 284
8	1900	-Along Cross Result									1 1 1	S on 205
9	0100	-Along Cross Result									3 2 4	N off 14
9	0700	-Along Cross Result	24 18 30	S off 123	165	5 0 5	N 340	South	8	S	5 2 5	S on 182
9	1300	-Along Cross Result										
9	1900	-Along Cross Result									1 3 3	S on 232
10	0100	-Along Cross Result									3 1 3	N on 322
10	0700	-Along Cross Result	102 0 102	S 160	152	25 6 26	S on 174	North	10	S	25 1 25	S on 162
10	1300	-Along Cross Result									8 1 8	S on 167
10	1900	-Along Cross Result									6 1 6	S on 169

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

TABLE 4: Current Data
JUL 1987

Day	Time	Alongshore Cross-shore Result	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
11	0100	-Along Cross Result									10 3 10	S on 177
11	0700	-Along Cross Result	61 15 63	S off 146	189	14 4 14	S off 143	North	5	S	20 3 20	S on 169
11	1300	-Along Cross Result									19 5 20	S on 175
11	1900	-Along Cross Result									14 4 15	S on 176
12	0100	-Along Cross Result									12 5 13	S on 183
12	0700	-Along Cross Result	30 5 31	S off 151	189	14 1 14	S on 166	South	4	N	15 2 15	S off 152
12	1300	-Along Cross Result									20 3 20	S on 169
12	1900	-Along Cross Result									3 2 4	S off 126
13	0100	-Along Cross Result									10 2 10	S off 149
13	0700	-Along Cross Result	20 12 24	S on 191	140	5 1 5	S off 146	North	3	S	6 1 6	S off 151
13	1300	-Along Cross Result									18 3 18	S on 169
13	1900	-Along Cross Result									2 2 3	N on 295
14	0100	-Along Cross Result									4 1 4	S on 174
14	0700	-Along Cross Result	3 5 6	S off 97	140	14 3 14	N off 351	North	6	S	1 1 1	S on 205
14	1300	-Along Cross Result									11 6 13	S on 189
14	1900	-Along Cross Result									6 0 6	N 340
15	0100	-Along Cross Result									13 6 14	S on 185
15	0700	-Along Cross Result	25 0 25	S 160	165	102 102 144	S off 115	North	102	S	20 6 21	S on 177
15	1300	-Along Cross Result									26 5 26	S on 171
15	1900	-Along Cross Result									3 3 4	S on 205

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

TABLE 4: Current Data
JUL 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
16	0100	Along Cross Result									6 3 7	S on 187
16	0700	Along Cross Result	no observ		165	6 6 9	N off 25	no observation			2 2 3	S on 205
16	1300	Along Cross Result									12 6 13	S on 187
16	1900	Along Cross Result									12 2 12	S on 169
17	0100	Along Cross Result									11 4 12	S on 180
17	0700	Along Cross Result	18 9 20	S on 187	165	20 41 45	N on 277	North 10 S			8 2 8	S on 174
17	1300	Along Cross Result									13 4 14	S on 177
17	1900	Along Cross Result									10 3 10	S on 177
18	0100	Along Cross Result									11 1 11	S off 155
18	0700	Along Cross Result	8 3 9	S off 138	165	6 8 10	N off 31	North 9 S			1 0 1	S 160
18	1300	Along Cross Result									7 1 7	S on 168
18	1900	Along Cross Result									3 1 3	S on 178
19	0100	Along Cross Result									5 4 6	N off 19
19	0700	Along Cross Result	5 11 12	S on 226	165	51 38 63	N off 17	South 9 N			8 3 9	N off 1
19	1300	Along Cross Result									6 5 8	N on 300
19	1900	Along Cross Result									1 2 2	S off 97
20	0100	Along Cross Result									8 0 8	N 340
20	0700	Along Cross Result	11 0 11	S 160	165	34 8 35	N off 354	South 13 S			5 1 5	S off 149
20	1300	Along Cross Result									5 7 9	N on 286
20	1900	Along Cross Result									5 0 5	N 340

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
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on = onshore off = offshore

TABLE 4: Current Data
JUL 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
21	0100	Along Cross Result									5 4 6	N on 301
21	0700	Along Cross Result	8 2 8	N off 354	165	5 5 7	N off 25	South	3	N	6 1 6	S on 169
21	1300	Along Cross Result										
21	1900	Along Cross Result									11 0 11	S 160
22	0100	Along Cross Result									5 1 5	N on 329
22	0700	Along Cross Result	25 0 25	S 160	152	12 6 14	N on 313	South	46	N	9 8 12	S on 202
22	1300	Along Cross Result									16 4 16	S on 174
22	1900	Along Cross Result									21 4 21	S on 171
23	0100	Along Cross Result									19 10 21	S on 188
23	0700	Along Cross Result	32 0 32	S 160	152	11 11 16	S on 205	North	30	N	29 4 29	S on 168
23	1300	Along Cross Result									24 9 26	S on 181
23	1900	Along Cross Result									3 0 3	S 160
24	0100	Along Cross Result									1 1 1	N off 25
24	0700	Along Cross Result	3 14 14	N on 264	152	22 16 27	N on 303	South	38	N	3 1 3	S off 142
24	1300	Along Cross Result									8 2 8	N off 354
24	1900	Along Cross Result									9 1 9	N on 334
25	0100	Along Cross Result									11 2 11	N on 330
25	0700	Along Cross Result	20 17 27	N on 300	165	24 18 30	N on 303	South	9	N	22 1 22	N on 337
25	1300	Along Cross Result									11 2 11	N off 350
25	1900	Along Cross Result									20 4 20	N off 351

KEY = All speeds in CM/SEC
 N = Northward, Shore parallel
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 on = onshore off = offshore

TABLE 4: Current Data
JUL 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
26	0100	-Along Cross Result									2 1 2	S off 133
26	0700	-Along Cross Result	15 3 16	N on 329	165	9 4 10	N on 313	South	43	N	1 2 2	S off 97
26	1300	-Along Cross Result									3 1 3	N on 322
26	1900	-Along Cross Result									9 5 10	N on 311
27	0100	-Along Cross Result									5 3 6	N off 11
27	0700	-Along Cross Result	8 15 17	S off 97	152	3 6 7	N off 43	South	43		5 2 5	S off 138
27	1300	-Along Cross Result										
27	1900	-Along Cross Result									4 2 4	S off 133
28	0100	-Along Cross Result									3 1 3	S on 178
28	0700	-Along Cross Result	30 30 43	S off 115	152	5 4 6	S off 123	South	3	N	10 0 10	S 160
28	1300	-Along Cross Result									13 2 13	S on 169
28	1900	-Along Cross Result									2 4 4	S on 223
29	0100	-Along Cross Result									18 8 20	S on 184
29	0700	-Along Cross Result	68 0 68	S 160	152	22 0 22	S 160	North	41	S	12 5 13	S on 183
29	1300	-Along Cross Result									26 8 27	S on 177
29	1900	-Along Cross Result									10 1 10	S on 166
30	0100	-Along Cross Result									12 5 13	S on 183
30	0700	-Along Cross Result	24 0 24	S 160	177	20 6 21	S off 143	North	15	S	9 4 10	S on 184
30	1300	-Along Cross Result									17 1 17	S on 163
30	1900	-Along Cross Result									3 0 3	S 160

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

TABLE 4: Current Data
JUL 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Dye 12m offshore (surface)		Location	Speed	Dir	Speed	Dir
Speed	Dir	Speed	Dir	Speed		Dir	Speed					
31	0100	-Along Cross Result								1 2 2	S off 97	
31	0700	-Along Cross Result	41 20 45	N off 7	165	36 9 37	N off 354	South	28	N	9 3 9	S off 142
31	1300	-Along Cross Result									11 35 37	N off 53
31	1900	-Along Cross Result									24 146 148	S off 79

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

V. SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves) but not surface chop or capillary waves. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 east of true north; consequently, wave angles greater than 70 imply the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about .3 m (1 ft) into the water and allowed to remain for at least one minute. The jar is removed, the temperature read and a hydrometer is used to determine the density. A secci disc is used to determine the surface visibility.

TABLE 5

SUPPLEMENTAL OBSERVATIONS

JUL 1987

DAY	TIME	WAVE APPROACH ANGLE AT PIER END deg from True N		RADAR WAVE ANGLE deg from True N	WIDTH OF SURF ZONE(m)	WATER CHARACTERISTICS AT PIER END		
		Primary	Secondary			TEMP(C)	DENSITY (g/cc)	SECCI VIS(m)
1	740	95		80	49	16.1	1.0234	4.6
2	735	80		95	52	15.0	1.0234	4.3
3	740	95	90	80	58	15.5	1.0234	4.0
4	800	90		90	58	16.0	1.0241	4.6
5	1147	no observation		80	49	16.1	1.0240	3.4
6	825	95		90	55	17.2	1.0234	4.9
7	800	65		60	58	23.9	1.0188	3.0
8	720	70		70	61	20.0	1.0220	4.3
9	655	95		75	49	19.5	1.0224	5.2
10	710	80	90	80	43	25.5	1.0202	3.0
11	1100	80		80	36	27.9	1.0192	3.4
12	1130	no observation		75	23	27.2	1.0190	2.7
13	830	85		85	34	26.6	1.0185	4.9
14	745	80		80	30	23.9	1.0200	5.5
15	800	40		55	64	23.4	1.0204	4.3
16	800	40		55	70	23.4	1.0200	4.0
17	730	60		55	70	23.9	1.0200	3.7
18	1000	65		60	52	24.4	1.0194	5.2
19	515	75		75	58	24.1	1.0211	3.0
20	835	70		75	46	24.7	1.0205	4.0
21	720	90		85	46	24.2	1.0212	4.9
22	730	75	60	70	37	26.1	1.0202	7.0
23	720	70		65	43	26.6	1.0192	5.5
24	720	75		75	40	26.9	1.0190	4.9
25	1005	35		75	52	27.2	1.0201	4.6
26	1047	none visible		80	52	22.8	1.0220	3.0
27	900	110		80	41	17.2	1.0236	5.2
28	800	95		85	24	23.3	1.0206	4.3
29	720	45		60	29	25.5	1.0188	4.0
30	750	35		40	34	26.1	1.0183	4.0
31	730	90		75	34	22.8	1.0218	4.9

VI. WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect data every 6 minutes throughout the month.

Figure 4 shows the variation in mean water levels computed over a tidal cycle period (12.42 hours), and contains a list of selected mean and extreme values. This presentation is useful in identifying effects on both meteorological and astronomical forces on the open coast water levels.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

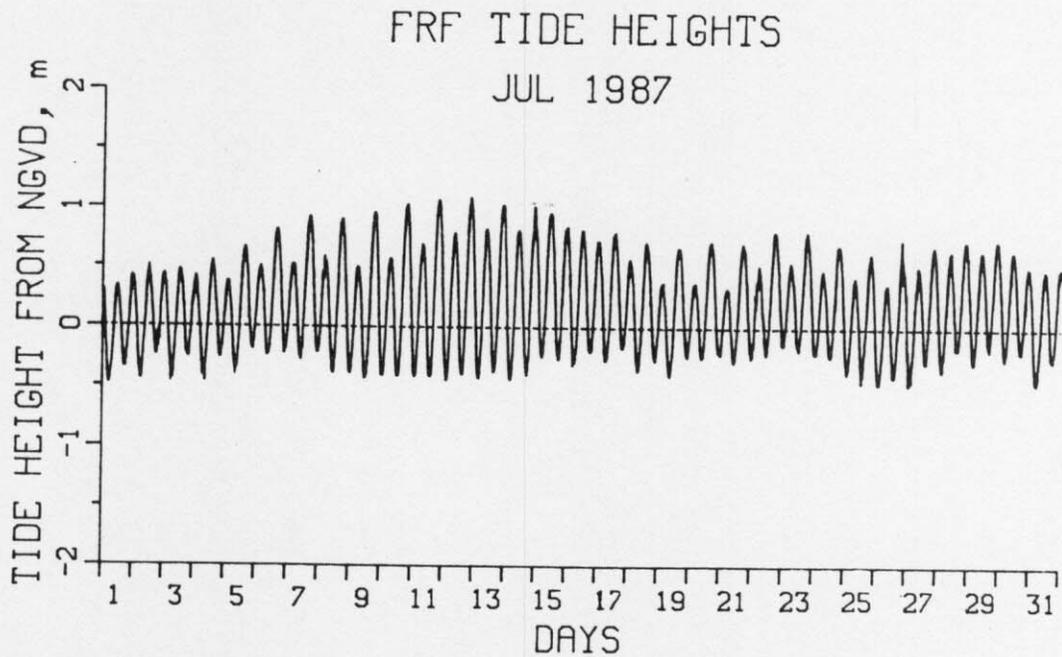


FIGURE 4. Time History of Mean Water Levels, July 1987

MONTHLY WATER LEVELS (METERS NGVD)

EXTREME LOW	=	-0.53	ON DAY 16 AT 448HRS.
EXTREME HIGH	=	1.09	ON DAY 12 AT 2012HRS.
MONTHLY MEAN	=	0.18	
MEAN LOW	=	-0.32	
MEAN HIGH	=	0.72	
MEAN RANGE	=	1.05	

Table 6: WATER LEVELS (METERS NGVD)

MID-CYCLE DAY TIME	LOW	HIGH	MEAN	RANGE
1 612	-0.48	0.33	-0.06	0.81
1 1837	-0.34	0.42	0.04	0.76
2 703	-0.44	0.51	0.01	0.94
2 1928	-0.23	0.44	0.11	0.67
3 753	-0.48	0.47	0.03	0.94
3 2018	-0.25	0.42	0.09	0.67
4 843	-0.46	0.55	0.05	1.01
4 2109	-0.25	0.37	0.09	0.63
5 934	-0.45	0.66	0.12	1.12
5 2159	-0.18	0.52	0.19	0.70
6 1024	-0.24	0.81	0.25	1.05
6 2249	-0.22	0.66	0.22	0.87
7 1115	-0.27	0.93	0.30	1.19
7 2340	-0.21	0.79	0.23	1.00
8 1205	-0.38	0.91	0.23	1.29
9 30	-0.38	0.77	0.13	1.15
9 1255	-0.42	0.96	0.21	1.39
10 121	-0.40	0.84	0.15	1.24
10 1346	-0.41	1.03	0.25	1.44
11 211	-0.41	0.95	0.21	1.36
11 1436	-0.41	1.07	0.28	1.48
12 301	-0.44	0.99	0.24	1.43
12 1527	-0.39	1.09	0.30	1.48
13 352	-0.42	0.96	0.26	1.38
13 1617	-0.37	1.03	0.31	1.40
14 442	-0.43	0.91	0.24	1.34
14 1707	-0.39	1.02	0.27	1.41
15 532	-0.24	0.96	0.37	1.20
15 1758	-0.26	0.94	0.33	1.19
16 623	-0.53	0.82	0.26	1.35
16 1848	-0.20	0.74	0.29	0.94
17 713	-0.27	0.80	0.24	1.07
17 1938	-0.16	0.76	0.25	0.92
18 804	-0.36	0.72	0.15	1.07
18 2029	-0.27	0.66	0.13	0.93
19 854	-0.40	0.67	0.09	1.07
19 2119	-0.24	0.66	0.15	0.90
20 944	-0.24	0.72	0.17	0.96
20 2210	-0.22	0.71	0.15	0.93
21 1035	-0.28	0.71	0.14	0.99
21 2300	-0.25	0.67	0.19	0.92
22 1125	-0.22	0.81	0.24	1.02
22 2350	-0.14	0.77	0.27	0.91
23 1216	-0.18	0.81	0.26	0.99
24 41	-0.21	0.75	0.19	0.96
24 1306	-0.23	0.69	0.20	0.92
25 131	-0.37	0.65	0.09	1.02
25 1356	-0.45	0.62	0.10	1.07
26 222	-0.46	0.54	-0.01	1.00
26 1447	-0.40	0.74	0.06	1.14
27 312	-0.47	0.52	0.05	0.98
27 1537	-0.28	0.69	0.19	0.97
28 402	-0.35	0.65	0.14	1.00
28 1628				
29 453	-0.28	0.65	0.20	0.93
29 1718	-0.17	0.73	0.29	0.91
30 543	-0.25	0.65	0.21	0.90
30 1808	-0.20	0.52	0.18	0.71
31 634	-0.45	0.49	0.01	0.94
31 1859	-0.26	0.51	0.08	0.77

VII. NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in June and the three surveys taken during July on profile line 188, located 517 m south of the pier. As a result of the low wave conditions during July, only minor changes are visible on the profile. The most significant change was the transformation of the nearshore bar (120 to 240 m) into a smooth featureless slope.

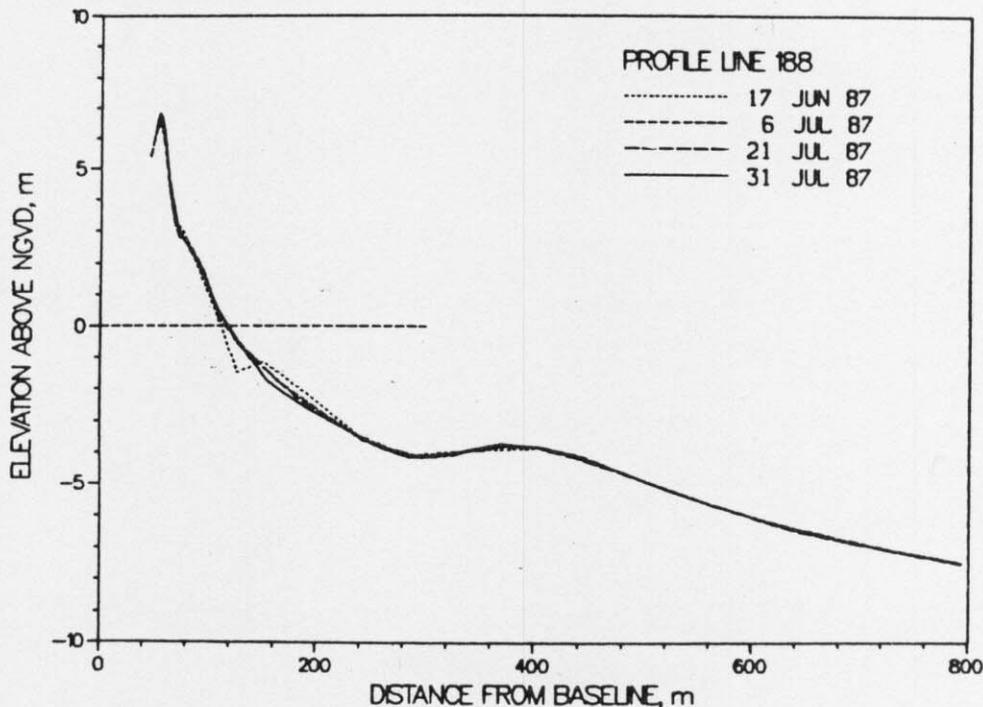


Figure 5. Monthly CRAB profiles on profile 188 - 517 meters south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile since the end of 1986. The most dramatic change was a result of accretion in the nearshore trough (120 m).

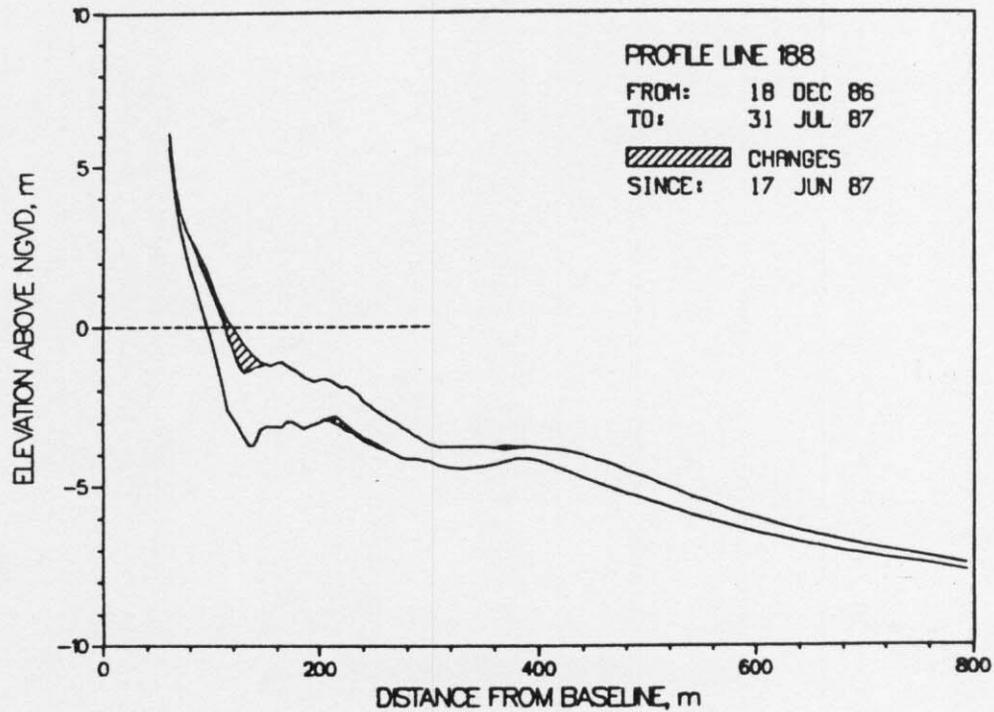


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 is a contour map showing this month's bathymetric survey.

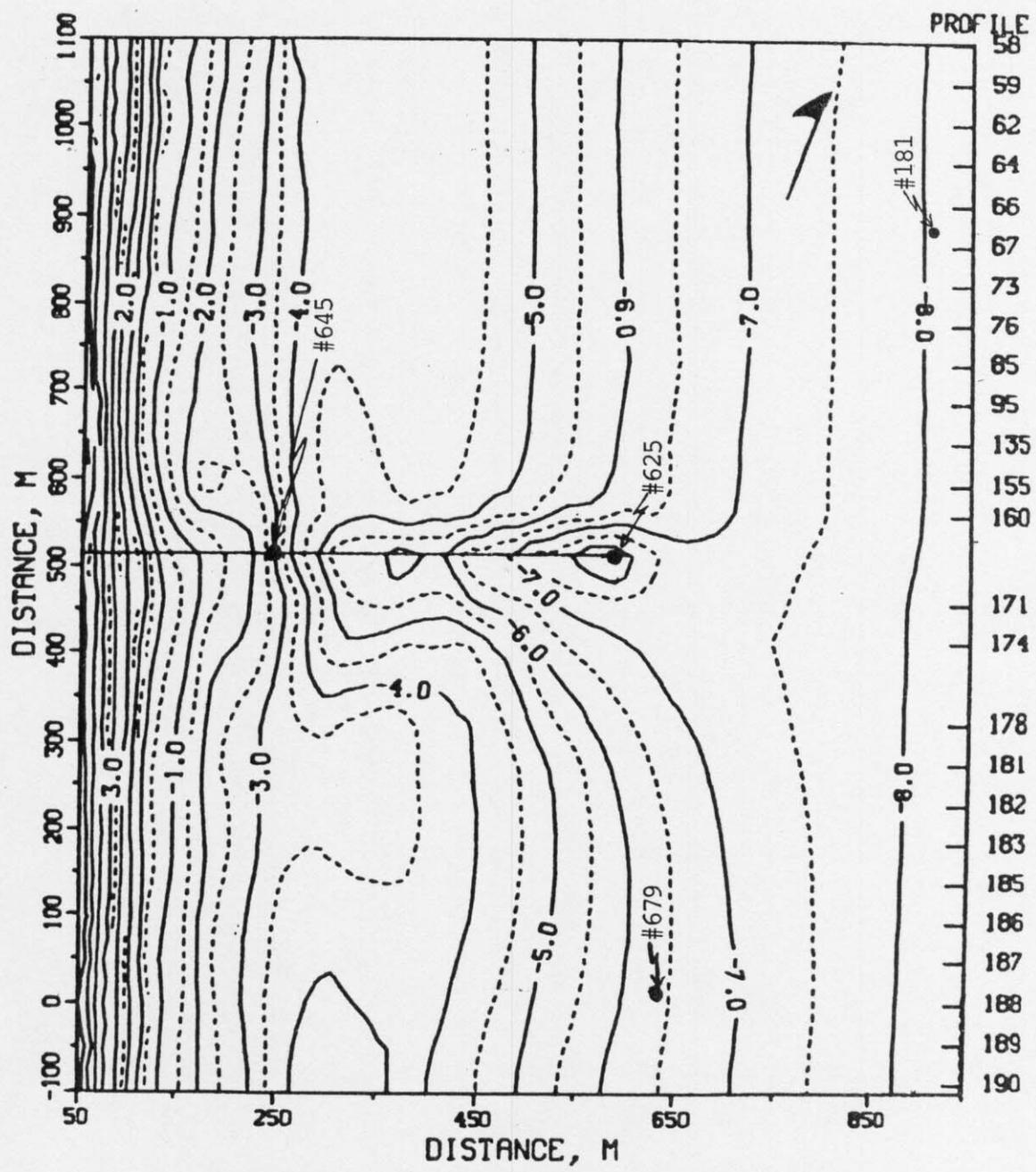


FIGURE 7. FRF BATHYMETRY 22 JUL 87
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